sea, but to effect a great economy in coal-consumption. Since then the new system has come rapidly into use, and shipbuilders and marine engineers are now looking in the direction of triple and quadruple expansion-engines for the economical advantages of high-pressure steam in future ships.

It is estimated that the present triple-expansion marine engine, with 150 lbs. of steam-pressure, has an advantage of from 20 to 25 per cent. in economy of coal consumption, over the ordinary compound engine with 90 lbs. pressure, which it is rapidly supplanting. These results have been achieved through a clear appreciation of the waste of energy which is caused by the alternate heating and cooling of a steam cylinder that takes place in consequence of the difference of temperature at which the steam enters and leaves it. The steam-jackets introduced by James Watt as a cure for this were imperfect and wasteful in their action. An effectual remedy has been found as the result of many years of study and experiment by men of science and engineers, by expanding the steam successively in several cylinders, so as to make the variation of the temperature of the steam in each cylinder as small as possible.

NOTES

WE greatly regret to announce the death of Mr. George Busk, F.R.S., the well-known surgeon and naturalist, in the seventy-eighth year of his age. We must reserve a detailed notice of Mr. Busk's life and work.

GEOLOGISTS will be sorry to hear of the death of Mr. Gerrard Kinahan, son of the well-known geologist of the Geological Survey of Ireland. Last October he accepted an appointment in the service of the National African Trading Company. The last letter received from him gave an interesting account of his explorations up the southern tributaries of the Niger. He died on May 23 from a wound with a poisoned arrow in a fight with the native tribes at a place called Anyappa. His training as a chemist and geologist at the College of Science in Dublin and also at the School of Mines in London had thoroughly qualified him for original research, and his quietly enduring temperament and kindliness of nature augured a most successful scientific future, whether at home or abroad. But he has been cut down on the very threshold of his career—another young victim to the dangers of African exploration.

THE death is announced of Dr. R. J. Mann, F.R.C.S., aged sixty-nine. Dr. Mann was for three years President of the Meteorological Society, and was a Member of the Astronomical, Geographical, Photographic, and other Societies. He gave up his medical practice to take a Government appointment in Natal, where he served as head of the Education Department and Medical Officer for many years. On his return, about 1864, he became Emigration Agent for the Colony, and when, some ten years later, he resigned that post, he devoted himself to his favourite scientific pursuits. He was a popular and prolific writer. The protection of buildings from lightning was a subject on which he wrote a good deal, and for which he did much valuable work.

M. CHEVREUL, the illustrious French chemist, will complete his hundredth year on Monday next. A grand *fête* at the Museum in honour of the occasion is being organised. Delegations from foreign countries as well as from the provinces are expected. In one of the *salles* at the Museum there is to be an exhibition presenting a *résumé* of the scientific labours and discoveries of M. Chevreul. The banquet will be at noon, in order that the famous centenarian may himself be present.

OUR Vienna correspondent writes:—"Dr. von Frisch, having recently experimented on preventive inoculations for hydrophobia, has made a preliminary communication to the Vienna Academy of Sciences, in which he states that it was impossible for him to prevent the breaking out of rabies by means of Pasteur's method if the infecting virus (of at least fourteen days' incubation) were administered to previously healthy animals by trepanning. This latter method of artificial infection of animals Dr. von Frisch suggests to be the only safe one. He made his experiments on rabbits and on dogs. At first sixteen healthy rabbits were trephined, and the virus (of sixteen days' incubation) was injected under the dura mater. Fifteen of these rabbits were then subjected at intervals to the usual preventive inoculations, the remaining one not being inoculated. All these animals except one, which, as Frisch believes, was not sufficiently infected, died between the fourteenth and thirty-third day after infection, with symptoms of rabies, and if particles of their spinal cord were injected into healthy rabbits, the latter also became rabid. Similar experiments were then made on dogs, and with the same results. But a series of rabbits infected by subcutaneous injection of the virus, and then treated by Pasteur's method, continue healthy up to the present time."

THE Grosvenor Museum for Chester and North Wales was opened at Chester on Monday by the Duke of Westminster. The new museum is intended as the home of four influential local societies—namely, the Chester Society of Natural Science, founded by Charles Kingsley; the Chester Archæological Society, which is closely associated with the name of the late Dean Howson; the Chester Schools of Art; and the Chester Science Classes. The first floor is devoted entirely to science, except one room to be used as a laboratory, a committee-room, and a model-room for the school of art. The upper floor is entirely devoted to the school of art. In the several rooms there are exhibited specimens illustrative of the natural history of the district, water-colour drawings, collections of antiquities, oil paintings, wood carvings, a collection of pictures by members of the Art Club, appliances for science teaching, memorials of Canon Kingsley and Dean Howson, a collection of objects illustrative of Oriental art, a magnificent collection of tapestry, choice embroidery, lace, porcelain, textile fabrics, &c.

THE autumn congress of the Sanitary Institute of Great Britain will be held in the city of York on September 21 and following days, under the Presidentship of Sir T. Spencer Wells, Bart.

THE summer meeting of the Institution of Mechanical Engineers will be held on Tuesday morning, August 17, and Wednesday morning, August 18, at 25, Great George Street, Westminster. The following papers have been offered for reading and discussion after the address by the President:—Experiments on the steam-jacketing and compounding of locomotives in Russia, by M. Alexander Borodin, of Kieff; on the working of compound locomotives in India, by Mr. Charles Sandiford, of Lahore; description of a portable hydraulic drilling-machine, by M. Marc Berrier-Fontaine, of Toulon; description of the Blackpool electric tramway, by Mr. M. Holroyd Smith, of Halifax; on triple-expansion marine engines, by Mr. Robert Wyllie, of Hartlepool.

THE French Association for the Advancement of Science begins its annual meeting to-day at Nancy.

THE lectures recently delivered at Oxford by Prof. Sylvester on his "New Theory of Reciprocants," will appear in the coming numbers of the *American Journal of Mathematics*. The lectures are presented in quite simple style, and will be exceedingly interesting to all students of the modern algebra, or, more accurately, of the theory of invariants. The first eight or nine lectures will appear in the forthcoming number of the *Journal*, vol. viii. No. 3.

A SOCIETY for the study of anthropology has been founded in Bombay. Before the departure of the East Indian mail the second ordinary meeting of the Society had been held, and Mr. E. Tyrrel-Leith, the President, was able to give a very satisfactory account of its prospects.

THE report of the Directors and Secretary of the City and Guilds of London Institute on the technological examinations of the present year has just been issued. It states that there is a large increase in the number of candidates who presented themselves, and a satisfactory increase in the number of those who have passed. In 1885, 3968 candidates were examined, of whom 2168 passed. In 1886, 4764 candidates were examined, of whom 2627 have passed. Examinations were held this year in 48 subjects. Applications for examination were received in all the 49 subjects, but, as only one candidate presented himself in sugar manufacture, in accordance with the regulations of the Institute no examination was held in this subject. Last year examinations were held in 42 subjects. The subjects in which there has been the greatest increase in the number of candidates are mechanical engineering, plumbers' work, electric lighting, and gas manufacture. One new subject was this year added to the list—namely, brickwork and masonry, in which 99 candidates came up, and of these 57 satisfied the examiners. In addition to the practical examinations in weaving and pattern designing, in metal-plate work, in carpentry and joinery, and in mine-surveying, which had been previously held, a practical examination was held this year for the first time in typography. Seventy-seven candidates presented themselves for this examination, of whom 32 have succeeded in obtaining a certificate. From the returns furnished in November last, it appears that 7660 persons were receiving instruction in the registered classes of the Institute, as compared with 6396 in the previous year. This increase is due partly to increased attendance at some of the classes, and partly to the formation of new classes, the number of classes in connection with the Institute having increased from 263 in the Session 1884-85 to 329 during the past year. These classes were held in 116 different towns of the United Kingdom. 203 prizes have this year been awarded, being an increase of 26 on those granted last year. These awards include 180 money prizes, 65 silver and 138 bronze medals, of which 62 are in the honours grade and 141 in the ordinary grade. Last year there were 177 money prizes, 51 silver and 126 bronze medals.

THE Norwegian Meteorological Institute of Christiania has adopted an ingenious plan for disseminating its weather reports among the farmers, fishermen, &c. Thus, on the brake of every train departing from the capital to any part of the country after 3 p.m. a signal is exhibited indicating the weather to be expected for the ensuing twenty-four hours. These signals are very simple, consisting of red and white triangles, squares, and balls, each of which, or several combined, have their meaning; a white ball, for instance, "fine weather," &c. These signals will also be displayed from the masts of several coasting steamers. The arrangement is in force from July 1 to October 1.

ACCORDING to the official returns of the Minister of Education in Prussia the number of students in philology and the kindred subjects of philosophy and history in that kingdom—now for a considerable time known to be sensibly on the decrease in the field of the ancient classics—has altogether steadily declined from Michaelmas 1881 to Easter 1885. The number of students of philosophy, philology, and history at the Universities of Prussia amounted in the winter session of 1881-82 to 2522, in the summer session of 1882 to 2535, in the winter session of 1882-83 to 2504, in the summer session of 1883 to 2398, in the winter session of 1883-84 to 2311, in the summer session of 1884 to 2258, and in the winter session of 1884-85 to 2181. Within a period of 3½ years, therefore, the decline in the number of students of philosophy, philology, and history has been about 14 per cent.

A LARGE specimen of the lizard tribe imported from Japan into the Colonial and Indian tropical aquarium lately died in the act of extruding her eggs, numbering eight. One of her feet that had become broken during her existence was found to have grown again. A further consignment of turtles has arrived at the aquarium together with a number of eggs, which have been placed in the Chelonian hatchery for incubation. Some fine specimens of foreign oysters have also arrived.

THAT kingfishers possess a remarkable instinct to avoid those fish proving harmful to them is exemplified by the following incident. A correspondent informs us that being infested with these birds he set traps for them in two of his ponds, one containing minnows and the other perch. A capture was effected daily where the minnows were located, but on no occasion was a kingfisher caught near the perch pond. The latter fish are injurious to birds.

M. GASTON TISSANDIER in a recent number of *La Nature* describes the efforts made by himself and his brother to pursue the subject of aërial photography. For this purpose they sought the assistance of M. Paul Nadar, whose father made the first attempts twenty-eight years ago, to take photographs from balloons. An ascent was made on July 2 from Auteuil, the descent taking place after a voyage of about six hours at Ségrie in La Sarthe, the length of the journey being about 180 kilometres. The maximum altitude exceeded 1700 metres. During the voyage M. Nadar succeeded in executing thirty instantaneous photographs, a dozen of which are, M. Tissandier says, unquestionably the most perfect yet obtained from a balloon. These were taken at various altitudes, ranging from 800 to 1200 metres. They were perfect in all details, but lose by reproduction by heliogravure. Those taken at 1200 metres it has been found impossible to reproduce at all, as they lose all their fineness in the process. The apparatus was placed in different positions on the edge of the car, sometimes being almost vertical, sometimes inclined so as to form with the horizon an angle varying from 25° to 45°. The time in each case was 1/250th part of a second. M. Nadar has enlarged some of the photographs with the new Eastmann paper with remarkable success. It is obvious from the illustrations given in *La Nature* that the photographs have suffered in the reproduction, the details being slightly blurred and indistinct, but the streets, principal houses, gardens, &c., are perfectly clear in the two pictures which were taken at altitudes of 800 and 1100 metres respectively.

A RECENT number of the *British North Borneo Herald* contains a report on the climate of North Borneo, by Dr. Walker, the principal medical officer, which is interesting as being the first scientific account of the meteorology of this recent addition to the British Empire. The climate, Dr. Walker says, is noticeable for nothing more than for its equability and the absence of extremes. The temperature, rainfall, winds, natural phenomena generally, and the diseases are, for a tropical country, of the most mild and temperate types. The country is visited by the regular monsoons at the ordinary times; the rainfall near the coast, according to records kept for seven years past, ranged from 156·9 to 101·26, and averaged 124·34. The temperature recorded at the coast has ranged between the extremes of 67°·5 and 94°·5; better arrangements are now being made for observing temperatures. The absence of tornadoes and earthquakes is to be noticed. The only indication at the present day of the existence of volcanic action is a hot spring, which is reported to exist on an island near the coast. The bulk of the report is occupied with information of a more medical kind, such as the chief diseases, and their respective effects on the various races, native and immigrant, in North Borneo; sanitaria, and the like.

AT a recent meeting of the Anthropological Institute at the Colonial Exhibition, Mr. Swettenham, of the Straits Civil

Service, read a paper on the races of the Straits Settlements. Of the Malays he said it was unlikely that they could be indigenous to the peninsula, but where they came from, whether Java, Sumatra, or elsewhere in the Archipelago, is a question which has never yet met with a satisfactory answer. Their own tradition is that they had a supernatural origin, and that they crossed from Sumatra. Up to about 1250 they were pagans, or followed some form of Hindoo worship, but about that time their conversion to Mohammedanism began. Up to this time, Malay, of all the Sumatran languages, had no written character of its own, but then Perso-Arabic characters were introduced, and many Arabic words found their way into the Malay language. Relics of Hindoo superstitions are still found amongst the Malays and Negritos of the peninsula, and the customs even now observed, especially in Perak, on certain occasions savour strongly of devil-worship. As to the Negritos, Mr. Swettenham remarked that the most complete collection of the clothing, weapons, and ornaments of these people ever yet brought together will be found in the Straits Settlements Court of the Exhibition. His own observation led him to divide the Negritos into two widely different sections—the Sakai and the Semang—the former a people of moderate stature and large bones, rather fairer in complexion than Malays, with long unkempt wavy hair standing straight out from their heads; the latter small and dark, with black frizzy hair close to their heads, like that of the Negro races. Some writers have found in the comparison of languages a connecting link between the Negritos of various tribes and Malays, and believe the former to show traces of Melanesian blood. The paper contains many interesting observations on the manufactures of the Malays, and on the customs of these and the Negritos.

WE have received two excellent memoirs of American men of science, recently read before the National Academy. The first is by Mr. J. D. Dana, and deals with the life and work of Arnold Guyot; the second, the life of Jeffries Wyman, by Mr. A. S. Packard. In each case the work appears to be done admirably, and a list of the writings of the subject of the memoir is appended. At the beginning of his account of Guyot, Mr. Dana notices as a remarkable fact in the history of American science, that, forty years since, the same Republic of Switzerland lost, and America gained, three men of science who became leading men of the country in their several departments—Agassiz in zoology, Guyot in physical geography, and Lesquereux in palæontological botany. A fourth—De Pourtalès, who accompanied Agassiz—also deserves prominent mention, for he was the pioneer of deep-sea dredging in America. The Society of Natural Sciences of Neuchâtel lost all four to the United States between 1846 and 1848. The memoir of Wyman (the list of whose papers, &c., reaches the number of 1875) concludes with a very touching portrait from the pen of Dr. Oliver Wendell Homes, and an ode by Mr. Russell Lowell.

NOS. 25 and 26 of *Excursions et Reconnaissances*, which have just reached this country from Saigon, do not contain so much matter of general interest as usual. In both M. Landes continues his collection of the folk-lore of Annam, under the title "Contes et Légendes Annamites." In No. 26 M. Silvestre, an official connected with the administration of native affairs, has a short paper on the Chao tribe of the Hung-hoa province of Tonquin, which is interesting as showing incidentally the vast number of various tribes, or tribes under various names, which exist in French Indo-China. How far they are related to each other and to some earlier race of which they are the fragments is one of the ethnological problems of the future. Lieut. Campion describes a voyage made in a despatch-vessel to various islands lying off the coast of Cochin-China, which have hitherto been unvisited by Europeans; and the indefatigable M. Aymonier continues the publication of an encyclopædic work on Annam.

A RECENT number of the *American Meteorological Journal* contains an article on the notorious dust-storms of Pekin. These occur in the dry season, especially in winter and early spring. They come on at irregular intervals, perhaps six or eight times in the season, and last about three days. The wind is westerly, most often north-west, and blows fresh or high. The condition of the streets of Pekin, evil as that is, would not account for the heavy clouds of dust that come down with the storm. The mouth and eyes have to be protected from the fine dust, which penetrates the closest room, and makes food to taste gritty. This abundant dust is spread over a large area. It extends eastward from Pekin to the sea, and south-eastward it regularly descends as far south as the Yellow River, and sometimes Shanghai, 10° of latitude away. The writer of the paper says this vast quantity of dust must come from the great deserts of Mongolia. A series of observations during one of these storms showed a fall in the thermometer when it came on, and a rapid change in the barometer, which rose from 786 mm. to 797 mm. making several rises and falls of less magnitude in the meantime. The clouds, which the day before had been unbroken, rapidly cleared away; the sun was so obscured that it could be inspected by the naked eye; it was also set in a ring. The wind showed diurnal variations, the air was dry, and one had a feeling of malaise and nervousness. After the wind went down, the barometer remained high for a day or two, and on its descent there was another, but much less marked, dust-storm. The storm thus appears to have been a gale accompanying an area of high pressure, which came from the Desert of Gobi and travelled eastward. The dryness of the wind and its abundant dust were in part due to this desert, which lies west and north-west of Pekin, and is not far away. In his great work on China, Richthofen discusses the geological effects of these storms, which are observed throughout the south and west of the Desert of Gobi, and further west are much worse than at Pekin.

A LATE number of the *Journal* of the Asiatic Society of Bengal contains a short memorandum by Prof. Pedler, of the Presidency College, Calcutta, on certain experiments which he has made on the corrosion of the lead linings of Indian tea-chests—a subject of considerable importance in more senses than one. His conclusions are that tea properly manufactured in the ordinary way has no power to corrode lead; but if unseasoned and damp wood is used for the boxes, corrosion of the lead is almost certain, some varieties of wood acting more violently than others. Even with seasoned wood, if it becomes saturated with water, and be then placed in favourable circumstances of heat and moisture, corrosion takes place. The active agent, he thinks, does not exist ready formed in unseasoned wood, but is produced by a secondary action from the constituents of the wood. The corrosion is not due usually to contact action between the lead and the wood, but a volatile substance is gradually produced from the unseasoned wood. The corroding agent is usually acetic acid in the presence of moist air and carbonic acid, but other acids of the same series are sometimes produced and also act on the lead, and in the case of butyric and valeric acids the incrustation is of a greenish yellow, while that from acetic acid is whitish or yellowish. The lead being corroded by these acids, which are produced by the decomposition of substances known to be present in the woods, the tea takes up the disagreeable odour of the latter after they have undergone the change in which acetic, butyric, and the other acids are formed, and will thus become deteriorated.

THE additions to the Zoological Society's Gardens during the past week include a Common Fox (*Canis vulpes* ♂), British, presented by Mr. J. W. Morgan; a Spotted Ichneumon (*Herpestes nepalensis*) from Nepal, presented by Mr. Herbert W. Brown; a Common Polecat (*Mustela putorius*), British, presented by Mr. William Buckley; a Red-crested Cardinal (*Paro-*

aria cucullata) from South America, presented by Mr. W. E. Ayerst; four Florida Tortoises (*Testudo polyphemus*) from Florida, presented by Mr. Hugh Bellas; a Common Viper (*Vipera berus*) from Hampshire, presented by Mr. Gerald Waller, F.Z.S.; a Brown-throated Conure (*Conurus æruginosus*) from South America, a Roseate Cockatoo (*Cacatua roseicapilla*) from Australia, a Macaque Monkey *Macacus cynomolgus*) from India, deposited; a Bandicoot Rat (*Mus bandicoota*), a Bronze-spotted Dove (*Chalcopelia chalcopilos*), bred in the Gardens.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 *AUGUST* 15-21

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on August 15

Sun rises, 4h. 47m.; souths, 12h. 4m. 16·6s.; sets, 19h. 21m.; decl. on meridian, 14° 1′ N.: Sidereal Time at Sunset, 16h. 57m.

Moon (one day after Full) rises, 19h. 12m.*; souths, 0h. 13m.; sets, 5h. 19m.; decl. on meridian, 12° 13′ S.

Planet	Rises	Souths	Sets	Decl. on meridian
	h. m.	h. m.	h. m.	° ′
Mercury	5 13	12 4	18 55	9 7 N.
Venus	2 10	10 11	18 12	21 9 N.
Mars	10 48	15 59	21 10	10 23 S.
Jupiter	8 45	14 44	20 43	0 55 S.
Saturn	1 34	9 40	17 46	21 59 N.

* Indicates that the rising is that of the preceding evening.

Occultations of Stars by the Moon (visible at Greenwich)

Aug.	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image	
			h. m.	h. m.	°	°
17	4 Ceti	6	21 58	near approach	345	—
17	5 Ceti	6	22 3	22 32	10	323
17	B.A.C. 5	6	22 11	23 21	62	278
19	ν Piscium	4½	22 42	23 47	68	261

Aug. h.
16 ... 8 ... Mercury in inferior conjunction with the Sun.

Variable Stars

Star	R.A.	Decl.			
	h. m.	° ′		h. m.	
U Cephei	0 52·2	81 16 N.	Aug. 17,	21 28	*m*
Algol	3 0·8	40 31 N.	,, 20,	0 18	*m*
R Comæ	11 58·4	19 25 N.	,, 17,		*M*
W Virginis	13 20·2	2 47 S.	,, 17,	0 0	*M*
δ Libræ	14 54·9	8 4 S.	,, 21,	20 4	*m*
U Coronæ	15 13·6	32 4 N.	,, 15,	2 21	*m*
W Herculis	16 31·2	37 34 N.	,, 18,		*M*
U Ophiuchi	17 10·8	1 20 N.	,, 17,	2 56	*m*
			,, 17,	23 4	*m*
W Sagittarii	17 57·8	29 35 S.	,, 21,	0 0	*M*
U Sagittarii	18 25·2	19 12 S.	,, 15,	0 0	*M*
β Lyræ	18 45·9	33 14 N.	,, 20,	21 0	m_2
S Vulpeculæ	19 43·7	27 0 N.	,, 21,		*M*
R Sagittæ	20 8·9	16 23 N.	,, 19,		*m*
δ Cephei	22 24·9	57 50 N.	,, 20,	2 0	*m*

M signifies maximum; *m* minimum; m_2 secondary minimum.

TENTH ANNIVERSARY OF THE JOHNS HOPKINS UNIVERSITY

THE tenth anniversary of the Johns Hopkins University at Baltimore was celebrated on April 26 last. Of the addresses delivered on that occasion we reprint two, the second of which reviews the work of this distinguished institution since its foundation. The work of the University in every department of human knowledge is well-known and appreciated in this country, and it is unnecessary to add a word to the address of Dr. Thomas, beyond expressing a cordial hope that the future may, in the words of the very appropriate ode read on the occasion, be

"Smooth course and splendour of the sunset-smiles."

The following is the address delivered by Prof. Henry A. Rowland, Ph.D., who took for his subject "The Physical Laboratory in Modern Education."

"From the moment we are born into this world down to the day when we leave it, we are called upon every moment to exercise our judgment with respect to matters pertaining to our welfare. While nature has supplied us with instincts which take the place of reason in our infancy, and which form the basis of action in very many persons through life, yet, more and more as the world progresses and as we depart from the age of childhood we are forced to discriminate between right and wrong, between truth and falsehood. No longer can we shelter ourselves behind those in authority over us, but we must come to the front and each one decide for himself what to believe and how to act in the daily routine and the emergencies of life. This is not given to us as a duty which we can neglect if we please, but it is that which every man or woman, consciously or unconsciously, must go through with.

"Most persons cut this Gordian knot, which they cannot untangle, by accepting the opinions which have been taught them and which appear correct to their particular circle of friends and associates: others take the opposite extreme, and, with intellectual arrogance, seek to build up their opinions and beliefs from the very foundation, individually and alone, without help from others. Intermediate between these two extremes comes the man with full respect for the opinions of those around him, and yet with such discrimination that he sees a chance of error in all, and most of all in himself. He has a longing for the truth, and is willing to test himself, to test others, and to test nature until he finds it. He has the courage of his opinions when thus carefully formed, and is then, but not till then, willing to stand before the world and proclaim what he considers the truth. Like Galileo and Copernicus he inaugurates a new era in science, or, like Luther, in the religious belief of mankind. He neither shrinks within himself at the thought of having an opinion of his own, nor yet believes it to be the only one worth considering in the world; he is neither crushed with intellectual humility, nor yet exalted with intellectual pride; he sees that the problems of nature and society can be solved, and yet he knows that this can only come about by the combined intellect of the world acting through ages of time, and that he, though his intellect were that of Newton, can, at best, do very little toward it. Knowing this he seeks all the aids in his power to ascertain the truth, and if he, through either ambition or love of truth, wishes to impress his opinions on the world, he first takes care to have them correct. Above all, he is willing to abstain from having opinions on subjects of which he knows nothing.

"It is the province of modern education to form such a mind, while at the same time giving to it enough knowledge to have a broad outlook over the world of science, art, and letters. Time will not permit me to discuss the subject of education in general, and, indeed, I would be transgressing the principles above laid down if I should attempt it. I shall only call attention at this present time to the place of the laboratory in modern education. I have often had a great desire to know the state of mind of the more eminent of mankind before modern science changed the world to its present condition and exercised its influence on all departments of knowledge and speculation. But I have failed to picture to myself clearly such a mind, while, at the same time, the study of human nature, as it exists at present, shows me much that I suppose to be in common with it. As far as I can see, the unscientific mind differs from the scientific in this, that it is willing to accept and make statements of which it has no clear conception to begin with, and of whose truth it is not assured. It is an irresponsible state of mind without clearness of conception, where the connection between the thought and its object is of the vaguest description. It is the state of mind where opinions are given and accepted without ever being subjected to rigid tests, and it may have some connection with that state of mind where everything has a personal aspect and we are guided by feelings rather than reason.

"When, by education, we attempt to correct these faults, it is necessary that we have some standard of absolute truth: that we bring the mind in direct contact with it, and let it be convinced of its errors again and again. We may state, like the philosophers who lived before Galileo, that large bodies fall faster than small ones, but when we see them strike the ground together, we know that our previous opinion was false, and we learn that even the intellect of an Aristotle may be mistaken. Thus we are taught care in the formation of our